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(54) Multi-layer packaging material for RF sealing

(57) A packaging material laminate has an inner layer of RF energy absorbent material, e.g. an EVA containing more than 15%, preferably 18-28%, of vinyl acetate, a first outer layer of heat-sealable material substantially less absorbent of RF energy e.g. EVA containing less than 15%, preferably 4 to 9%, of vinyl acetate, and a second outer layer also of substantially less RF absorbent material and preferably of higher-melting material, e.g. high density polyethylene. Thus portions of the material can be superimposed with the polyethylene layers outermost, and clamped between RF welding jaws. Irradiation heats the intermediate layers, which heat the adjacent EVA outer layers, which are urged to seal together to form a package. The polyethylene does not melt, and so is readily separable from the jaws. The package interior is of EVA with only a low content of vinyl acetate, which will neither affect nor be affected by the package contents.

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SPECIFICATION

Multi-layer packaging material for RF sealing

This invention relates to packaging materials, and more particularly to materials which are sealable by radio frequency impulse.

Radio frequency (RF), also known as high frequency (HF), sealing is a well-established method of welding materials, especially plastics. However, it can only be used to certain materials which when placed in a RF field absorb energy and become hot. This energy absorption is measured by the loss factor, which is the product of the dielectric constant and the dissipation factor.

The main material used for RF sealing is plasticised polyvinyl chloride (PVC). However, for food and medical packaging PVC has certain disadvantages. A plasticiser is necessary, to make the material flexible and aid sealability, and this can migrate into the pack contents during storage. Also, under cold conditions common to storing such materials, PVC packs lose some flexibility, and are less able to withstand impact, resulting in an undesirably high proportion of pack breakages in transit and distribution.

Polyethylene is a material very commonly used in packaging, especially in the food industry, but it is almost unaffected by RF.

Ethylene vinyl acetate copolymer (EVA) exhibits high RF energy absorption, according to its vinyl acetate content. A vinyl acetate content of 15% or higher is generally recognised as being necessary for RF welding. EVA has been used in packaging, and has certain useful properties; these include easier heat sealing and high impact resistance under cold conditions. However, with a high vinyl acetate content it is a rather rubbery substance with a clinging surface, and does not have good moisture vapour barrier properties, nor is it easily printable.

According to the present invention there is provided a packaging material which is a laminate having an inner layer of RF energy absorbent material, an outer layer on one side of a heat-sealable material but which is substantially less absorbent of RF energy, and an outer layer on the other side which is also of substantially less RF absorbent material. Preferably the inner layer is substantially thicker than the heat-sealing layer. The other outer layer may also be substantially thinner than the inner RF absorbent layer.

A preferred material for the inner layer is EVA, which preferably has a vinyl acetate content of at least 15%, typically 18 - 28%. The heat-sealing layer is preferably also of EVA, but with a vinyl acetate content of less than 15%, typically 4 - 9%. Other heat sealable layers may comprise polyethylene or an ethylene copolymer. The other outer layer is preferably of a material which has a higher melting temperature than EVA, suitably high-density polyethylene (HDPE).

The laminate is preferably made by co-extrusion, but it could be made by other methods, such as lamination of separate plies, or coating.

Example

A pack for containing liquid enteral feed is conventionally made of plasticised PVC. The enteral feed often contains oily products and the oily materials in the feed tend to absorb plasticiser from the PVC. To prolong the shelf life of the feed the packs are stored at reduced temperatures typically between 1° - 5° and PVC loses some impact strength at these storage temperatures. Furthermore, empty packs are sterilised by gamma irradiation before being filled aseptically. The irradiation slightly impairs the properties of PVC.

In accordance with the present invention a pack for enteral feed is made from a co-extruded laminate, comprising an inner layer of EVA having a vinyl acetate content of 18 - 28% and a thickness of between 50 and 250 micrometres, an outer layer of EVA having a vinyl acetate content of 4 - 9% and a thickness of 5 - 50 micrometres, and on the other side an outer layer of HDPE also of 5 - 50 micrometres thickness. The pack is formed by RF welding of superimposed layers of this laminate, with the low vinyl acetate content EVA outer layers in contact with each other between the RF sealing jaws, the jaws therefore contacting the HDPE outer layers. The RF output causes the high vinyl acetate content EVA inner layer to heat until it melts the contacting EVA outer layers causing them to weld together. The selected temperature is insufficient to melt the HDPE outer layer, or at any rate to cause it to become discontinuous, and the HDPE readily separates from the RF sealing jaws at the end of the dwell (in contrast with EVA, which would tend to adhere to the jaws).

The resulting pack has various useful properties. When sterilised by gamma irradiation, this actually tends to strengthen the EVA by causing cross-linking. The interior of the pack has a surface of low vinyl acetate content EVA in contact with the enteral feed, and this is acceptable for storage purposes, whereas the higher vinyl acetate content inner layer material would normally be more affected by fats and oils and therefore not desirable for contact with foodstuffs. Also the layers would tend to block making packaging of the product difficult. On the other hand, the high vinyl acetate content inner layer not only provides the RF heating for the EVA outer layer, but also, being of substantial thickness, provides good strength and impact resistance. The HDPE outer layer, on the other hand, not only readily detaches from the RF sealing jaws, but also it has suitable surface properties, in particular it resists blocking when the laminate material is handled, especially in reel form; it has high moisture-vapour barrier properties; it can be loaded with a filler material for resistance to the transmission of light; and after electric discharge treatment it presents a printable surface.

CLAIMS

1. A packaging material which is a laminate having an inner layer of RF energy absorbent ma-

terial, a first outer layer on one side of a heat-sealable material but which is substantially less absorbent of RF energy, and a second outer layer on the other side which is also of substantially less RF absorbent material.

2. A packaging material according to claim 1 wherein said inner layer is substantially thicker than the heat-sealable layer.

3. A packaging material according to claim 2 wherein the second outer layer is substantially thinner than the inner RF absorbent layer.

4. A packaging material according to any preceding claim wherein the inner layer comprises EVA.

5. A packaging material according to claim 4 wherein said EVA has a vinyl acetate content of at least 15°

6. A packaging material according to claim 5 wherein said EVA has a vinyl acetate content of 18 to 28°

7. A packaging material according to any preceding claim wherein the heat-sealable layer comprises EVA with a vinyl acetate content of less than 15°.

8. A packaging material according to claim 7 wherein the heat-sealable layer comprises EVA with a vinyl acetate content of 4 to 9°.

9. A packaging material according to claim 7 or claim 8 wherein the second outer layer is of a material which has a higher melting temperature than EVA.

10. A packaging material according to any of claims 1 to 6 wherein the heat-sealable layer comprises polyethylene or an ethylene copolymer.

11. A packaging material according to any preceding claim wherein the second outer layer comprises high density polyethylene.

12. A packaging material according to any preceding claim when produced by co-extrusion.

13. A packaging material substantially as described and exemplified herein.

14. A package comprising RF sealed packaging material according to any preceding claim.

15. A package according to claim 14 filled with a food-stuff or medical material.

16. A method of producing a package comprising providing packaging material according to any of claims 1 to 13 and subjecting it to RF sealing.

17. A method according to claim 16 wherein the second outer layer of the packaging material is high density polyethylene, and the method comprises superimposing two layers of the packaging material with their second outer layers outermost, and applying opposed HF welding jaws which contact the outermost layers.

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